STRUCTURAL STEEL CONSTRUCTION
FIELD SECTION 712

712.1 SCOPE. To establish procedures for inspecting and reporting those items specified in Specification Sec 712 which are not always inspected by Bridge personnel or are not specifically covered in the Materials details of the Specifications, and inspection of shop coating of structural steel.

712.2 APPARATUS.

(a) Magnetic gauge, reading range of 0-40 mils [0-1000 μm] with calibration tool.

(b) Calibration Standard Set (1.5-8 mils)[38-200 μm].

(c) Pictorial Surface Preparation Standards for painting steel surfaces.

(d) Surface profile gauge, Keane-Tator Comparator, with appropriate reference disc for sand, grit, or shot blast.

(e) Sling psychrometer and relative humidity tables.

(f) Ferrous Surface Temperature Thermometer.

(g) Flashlight and mirror.

(h) Rule with suitable graduations to accurately measure the material to be inspected.

712.3 PROCEDURE. Normally all materials in Specification Sec 712 except paint and shear connectors will be inspected by Bridge personnel. Bolts, nuts, and washers accepted by PAL may be delivered directly from the manufacturer to the project without prior inspection. When requested by Bridge or Construction, Materials will inspect these and other miscellaneous items. Bridge is responsible for the inspection of shop coating of structural steel at fabricating plants.

712.3.1 Project Inspection and Sampling for PAL. Inspecting of PAL material will be as stated in this section and GS-13.

712.4 MISCELLANEOUS MATERIALS.

712.4.1 High Strength Bolts. All bolts, nuts, and washers should be from a PAL supplier in accordance with GS-13. If a supplier proposes to furnish structural steel connectors and is not on PAL, a request is to be made to Construction and Materials for acceptance into the PAL program. Once satisfactory submittals have been received, the supplier will be placed on the PAL. Bolts, nuts, and washers, for use other than bridge construction and in quantities less than 50, may be accepted from a PAL supplier without a PAL identification number.

712.4.1.1 Bolts and nuts specified to meet the requirements of ASTM A307 shall be accompanied by a manufacturer's certification statement that the bolts and nuts were manufactured to comply with requirements of ASTM A307 and, if required, galvanized to comply with requirements of AASHTO M232 (ASTM A153) or were mechanically galvanized and meet the coating thickness, adherence, and quality requirements of AASHTO M232 (ASTM A153) Class C. Certification shall be retained by the shipper. A copy should be obtained when

sampling at the shipper and submitted with the samples to the lab.

712.4.1.1.1 All bolts, nuts and washers are to be identifiable as to type and manufacturer. Bolts, nuts, and washers manufactured to meet ASTM A307 will normally be identified on the packaging since no special markings are required on the item. Dimensions are to be as shown on the plans or as specified.

712.4.1.1.2 Weight [mass] of zinc coating, when specified, is to be determined by magnetic gauge in the same manner as described for bolts and nuts in Field Sec 1040 of this Manual.

712.4.1.1.3 Samples for Laboratory testing are only required when requested by the State *Construction and Materials* Engineer, or when field inspection indicates questionable compliance. When samples are taken, they are to be taken at the frequency and of the size shown below. When galvanized bolts, nuts, and washers are submitted to the Laboratory, a minimum of 3 samples of each are required for Laboratory testing.

3 for lots of 0 to 800 pcs.	Each sample is to consist of
6 for lots of 801 to 8,000 pcs.	One bolt, nut and washer -
9 for lots of 8,001 to 22,000 pcs.	Submit for Dimensions, Weight [Mass] of
15 for lots of 22,001 pcs. +	Coating, Mechanical Properties.

712.4.1.1.4 If AASHTO M 164 (ASTM A325) bolts are to be used in lieu of ASTM A307 bolts or for other uses, the inspection and sampling procedures as set forth in Sec 712.4.1.2 of this Manual shall still be followed. Notify *Construction and Materials* if the substitution is made on PAL material.

712.4.1.2 High strength bolts, nuts, and washers specified to meet the requirements of AASHTO M164 (ASTM A325). Field inspection shall include examination of the certifications or mill test reports; checking identification markings; and testing for dimensions. The certifications or mill test reports, conforming to Specification 712.2.4, shall be retained in the district office. Samples for Laboratory testing shall be taken and submitted in accordance with the provisions set forth herein.

712.4.1.2.1 All lots containing 501 or more high strength bolts shall be sampled and submitted to the Laboratory for testing. If no lots offered contains 501 or more bolts, sample 10 percent of the lots offered, or one lot, whichever is greater. A lot is defined as all bolts of the same size and length, with the same manufacturer's lot identification, offered for inspection at one time. Samples shall be taken as follows:

Number of Bolts in the lot	Number of Bolts Taken for a sample*
150 and less	3
151 through 800	3
801 through 8000	6
8001 through 22,000	9
22,001 plus	15

*A minimum of 3 samples will be required for galvanized materials.

712.4.1.2.2 All lots containing 501 or more high strength nuts shall be sampled and submitted to the Laboratory for testing. If no lot offered contains 501 or more nuts, sample 10 percent of the lots offered or one lot, whichever is greater. A lot is defined as all nuts of the same grade,

size, style, thread series and class, and surface finish, with the same manufacturer's lot identification, offered for inspection at one time. Samples shall be taken as follows:

Number of Nuts in the lot	Number of Nuts Taken for a sample*
800 and under	1
801 through 8000	2
8001 through 22000	3
22000 and over	5

*A minimum of 3 samples will be required for galvanized materials.

712.4.1.2.3 All lots containing 501 or more high strength washers shall be sampled and submitted to the Laboratory for testing. If no lot offered contains 501 or more washers, sample 10 percent of the lots offered, or one lot, whichever is greater. A lot is defined as all washers of the same type, grade, size, and surface finish, with the same manufacturer's lot identification, offered for inspection at one time. Samples shall be taken as follows:

Number of Washers in the lot	Number of Washers Taken for a sample*
800 and under	1
801 through 8000	2
8001 through 22000	3
22000 and over	5

712.4.2 Slab Drains.

712.4.2.1 Slab drains are to be accepted on the basis of field inspection of dimensions, weight [mass] of zinc coating, and a satisfactory fabricators certification. The dimensions, weight [mass] of zinc coating, and material specification requirements are shown on the bridge plans.

712.4.2.2 Field determination of weight [mass] of coating is to be made on each lot of material furnished. The magnetic gauge is to be operated and calibrated in accordance with ASTM E376. At least three members of each size and type offered for inspection are to be selected for testing. A single-spot test is to be comprised of at least five readings of the magnetic gauge taken in a small area and those five readings averaged to obtain a single-spot test result. Three such areas should be tested on each of the members being tested. Test each member in the same manner. Average all single-spot test results from all members to obtain an average coating weight [mass] to be reported. The minimum single-spot test result would be the minimum average obtained on any one member. Material may be accepted or rejected for galvanized coating on the basis of magnetic gauge. If a test result fails to comply with the specifications, that lot should be resampled at double the original sampling rate. If any of the resampled members fail to comply with the specification, that lot is to be rejected. The contractor or supplier is to be given the option of sampling for Laboratory testing, if the magnetic gauge test results are within minus 15 percent of the specified coating weight [mass].

712.4.2.3 A fabricators certification shall be submitted to the engineer in triplicate stating that "The steel used in the fabrication of the slab drains was manufactured to conform to ASTM A36" or "A500, A501" as the case may be.

712.4.3 Miscellaneous Structural Steel.

712.4.3.1 Other structural steel items not requiring shop drawings also require inspection. Inspection includes a fabricator's certification identifying the source and grade of steel, as well

as verification of dimensions and inspection of any coating applied. The report is to include the grade of steel, coating applied, and results of inspection.

712.5 SHOP COATING.

712.5.1 General. Structural steel members and their components vary from project to project. The inspector should thoroughly familiarize himself with the plans, specifications, and special provisions pertaining to the particular project. The contractor is required to submit shop drawings for approval to the State Bridge Engineer, showing in detail his proposed procedure for fabricating and choice of paint system for shop painting if alternates are allowed. The District in which the fabrication plant is located will receive one copy of the approved shop drawing. If painting is done in another District, it will be the responsibility of that District to request drawings or special provisions from the other District. The inspector shall become thoroughly familiar with the approved shop drawings and pay particular attention to high strength field bolted contact surfaces, inaccessible areas, areas to be field welded, and other miscellaneous requirements. Changes or deviations from the approved plans, shop drawings, or specifications are not permitted without written approval of the State Bridge Engineer. Bridge will inspect and approve the fabrication of all members prior to shop coating. Fabrication approval may be documented and signed by the bridge inspector on Form B-179. The Districts will be notified by the plants when fabrication is completed and the steel is ready for shopcoat inspection.

712.5.2 Surface Preparation. The blast cleaned metal substrate shall be inspected prior to shop coat painting. This inspection requires experience, judgment, and care. The inspector should attempt to be as consistent as possible from day to day in his determinations of profile height and evaluation of the condition of blast cleaned surfaces as specified in Specification Sec 712.12.2. Any grease or oil shall be removed with solvent before blasting. After blasting, steel imperfections such as slivering shall be scraped off. Also care should be taken to be sure all blasting material is blown out of corners, etc.

712.5.2.1 The nominal profile height in mils [µm] is determined by a Keane-Tator surface profile comparator with reference to the appropriate disc for the type of abrasive used in the blast cleaning. The type of referenced disc must correspond with the type abrasive being used by the fabricator in blast cleaning. For example, if a mechanical Wheelabrator containing "shot" as the abrasive was utilized in cleaning the metal, the inspector shall use a "shot" reference disc on the comparator when estimating profile height of the metal substrate. A sufficient number of estimations, taken at random over the member, shall be made to assure specification compliance for profile height. Areas of surface irregularities, due to steel mill rolling, pitting by rust, etc., should not be considered part of the profile height readings. However, the degree of cleaning of these surface irregularities shall comply with the requirements of Specification Sec 712.12.2, Surface Preparation.

712.5.2.2 Contact surface areas of high strength and machine bolted connections shall receive detail inspection as to profile height and also dry film paint thickness. On these surfaces, Specification Sec 712.12.8 requires a dry film inorganic zinc paint thickness of not less than 1.5 [38 µm] and not more than 2.5 mils [64 µm]. Dry film paint thickness shall be corrected by substrate readings as described in MoDOT Test Method T45.

712.5.2.3 A required machine surface finish of 125 micro-inches [3 µm] or less, as described in Specification Sec 712.3.3.14, shall not be blast cleaned or painted. A protective coating as described in Specification Section 712.2.7 shall be applied to these machine surfaces for protection until delivered to the project site. A list of those protective coatings which have been qualified is shown in Field Section FS-712 Table 1 of this Manual. All machine surfaces greater than 125 micro-inches [3 µm] may be blast cleaned and painted.

712.5.3 Paint. The inspector shall insure that only inspected and approved paint or paint components of the specified system are used. Paint shall comply with Specification Sec 1045. Each batch or lot of each component of inorganic zinc paint for System C painting may have to be sampled at the fabricating plant and approved by the Laboratory prior to use if it has not been previously sampled. SiteManager data can be queried to determine whether a batch has been sampled. If sampling of paint is necessary, it shall be in accordance with procedures described in Field Sec 1045 of this Manual. A sample record, completed in SiteManager, shall be used as an identification record for the sample, and shall show necessary identifying information for each batch or lot.

712.5.4 Paint Application. Prior to application of shop coat paint, the inspector shall insure that the weather conditions, equipment, and procedures comply with Specification Sec 712.12.4 and 712.12.7 respectively. Dew point shall be determined in accordance with MoDOT Test Method T38. System C, inorganic zinc, in a spray application, will often show mud cracking if applied too heavily. Because of its very short drying time, it will form a powdery build up that will not flow properly and will not produce uniform coverage if the spray nozzle is not held perpendicular to the surface. Too thin of a film may result in salting, producing a porous coating and subsequent progressive rusting. System C does not have the ability to flow into contact joint areas so particular attention should be given at these points to insure uniform application of the paint. Paint shall be applied within 24 hours after blast cleaning. When more than one coat of paint is required, Specification Sections 712.12.3.1 and 712.12.7.4 shall govern.

712.5.4.1 Contamination. When newly painted surfaces are contaminated with sand, grit, dirt, etc., the area affected shall be cleaned of all paint and contaminates and repainted.

712.5.4.2 Dry film paint thickness shall be measured in accordance with MoDOT Test Method T45.

712.6 RECORDS. The inspector shall maintain a complete file of all data pertaining to shop coat painting of structural steel. Complete and accurate records of each day of blast cleaning and painting operations shall be kept in a field book. All pertinent data which in any way affects painting procedures such as weather conditions, equipment, type of abrasives, etc. shall be recorded in the field book. Data and all significant information shall be promptly entered in the field book.

712.7 SAMPLE RECORD. The sample record shall be completed in SiteManager, as described in Automation Sec 3510, and shall indicate acceptance, qualified acceptance or rejection. Appropriate remarks, as described in General Sec 7 of this Manual, are to be included in the remarks to clarify conditions of acceptance or rejection.

712.7.1 Miscellaneous Materials. SiteManager is to be used to submit samples to the Laboratory and as an inspection report. If all tests are performed and acceptance or rejection is made in the field, the inspector may authorize the sample. Otherwise, the inspector's supervisor shall authorize the sample. Completion of sample records for materials purchased under a Department purchase order is to be as described in Field Sec 2001 of this Manual.

712.7.2 Shop Coat Painting. SiteManager is to be used to report shop coat painting of fabricated structural steel bridge members. The fabricator will furnish to the inspector a copy of completed Form B-179, "Fabrication Inspection Shipment Release", Bridge, if the structural steel was inspected by Bridge. An example of this completed form is shown as Exhibit 712-A. Form B-179 will have been signed by the bridge inspector and shall also be signed by the shop coat inspector signifying approval and release for shipment of the itemized members after shop coating. A copy of this completed and signed form should be retained in the District files. There

will not be a From B-179, “Fabrication Inspection Shipment Release”, Bridge, for supplementary items accepted on Brand Name Registration and Guarantee or Certification and mill tests. Shop coat inspection conducted by Materials personnel shall include the fabricator's job number, Laboratory number under which paint was tested, and the system of paint used. Each item is to be identified, showing quantity and shop mark. A record shall be made in SiteManager indicating that the material has been properly inspected and which contract it applies to.

Form B - 179 Rev 1-80
100 Books - 1-80

MISSOURI DEPARTMENT OF TRANSPORTATION
DIVISION OF BRIDGES
FABRICATION INSPECTION SHIPMENT RELEASE

Fabricator ABC, Inc. Shop No. 80-26
Bridge No. A-605R Route 169
Project RS-169-1(12) Job No. 16-66-169-68 County Clay

Item	Shop Mark	No. of Item	Remarks	Item	Shop Mark	No. of Item	Remarks
A-Bolts	A 1	20		Girders	A 5	1	
"	B 1	10		"	B 5	3	
"	C 1	10		"	C 5	1	
Girders	A 2	1		"	A 6	1	
"	B 2	3		"	B 6	3	
"	C 2	1		"	C 6	1	
"	A 3	1		Diaph's	D 4	4	
"	B 3	3		"	E 4	4	
"	C 3	1		"	D 5	32	
"	A 4	1		"	E 5	8	
"	B 4	3		"	D 6	4	
"	C 4	1		"	E 6	4	

Date _____ Inspector _____

EXHIBIT 712-A